DEFINING ROVER SCIENCE PROTOCOLS FOR ROBOTIC SAMPLE RETURN

Completed Technology Project (2015 - 2019)

Project Introduction

GOALS AND OBJECTIVES On roving sample-return or caching missions, two central tension will be choosing the samples to be collected and stored (or potentially discarded in favor of later samples). The goal of this proposal is to reveal best practices in choosing samples, and provide experience in the decision-making protocols required to select optimal samples; thus it has immediate applicability to the definition of potential science operations scenarios for Mars 2020, but the generalized nature of the methodology and instruments will make results applicable to any sample mission. This proposal will explore and assess protocols that increase science return on sample caching or return missions by testing the efficacy of rover-based science methodologies (that is, the manner and sequence in which scientists use rover instrument suites to answer scientific questions). METHOD To isolate methods of rover-driven field activities from variables introduced in utilizing rover-associated hardware and instruments, we will conduct field work using commercial instruments that provide functionally similar information to flight-ready instruments, and utilize humans for mobility. This approach has been used successfully in our previously work on this topic (e.g. Yingst et al 2013, 2014). In this work, we will extend our experience to three Mars analog sites with biosignature preservation potential and characterize astrobiologically relevant materials. We will: (1) characterize three analog sites that have relevance to astrobiological signatures that may be encountered by rovers on Mars; (2) conduct fieldwork using two different roving approaches (linear and walkabout-first); (3) conduct fieldwork using traditional terrestrial field methodology, and compare results to rover results; (4) define lessons learned and make recommendations for future planetary sample cache and return. RELEVANCE This proposal fits the primary focus of the PSTAR program to 'develop a sound technical and scientific basis to conduct planetary research on other solar system bodies.' It is relevant to A) Science and B) Science Operations. A) Our field campaign will be science-driven, seeking in situ geologic clues to potentially habitable or past-habitable environments that can be detected by a rover, thus leading to 'a better understanding of how to seek, identify, and characterize life and life-related chemistry that may exist or have existed' in that environment. B) We will use a range of high-fidelity operational scenarios, constrained by parameters functionally similar to those of a rover mission, to determine which most efficiently maximize science return. Thus, this proposal will result in new science concepts of operations that will feed directly into the design of rover tactical planning and execution. It will also allow scientists to gain experience and assess best practices for conducting sample cache and return science on a tactical timeline.

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Planetary Science and Technology Through Analog Research

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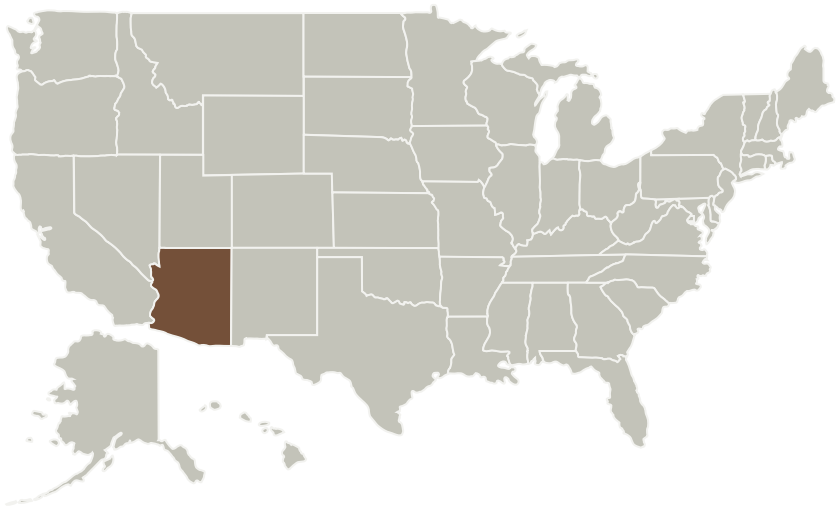
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Planetary Science Institute(PSI)	Supporting Organization	Industry	Tucson, Arizona

Primary U.S. Work Locations
Arizona

Project Management

Program Director:
Carolyn R Mercer

Program Manager:
Sarah K Noble

Principal Investigator:
R. A Yingst

Co-Investigator:
Elaine Owens

Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.2 Mobility
    - TX04.2.4 Surface Mobility

Target Destination

Others Inside the Solar System